Simultaneous Determination of Diclofenac Sodium and Chlorzoxazone from Combined Dosage Forms by Absorbance Difference Method

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A new spectrophotometric method for the simultaneous and separate estimation of diclofenac sodium and chlorzoxazone in binary tablet formulations has been described. The method is based on the estimation of one drug in presence of another drug by absorbance difference method. The diclofenac sodium and chlorzoxazone solutions were scanned over the range of 210 to 304 nm. In this method, two wavelengths 264 and 288 nm were selected for diclofenac sodium at these wavelengths the absorbance difference was almost zero and in case of chlorzoxazone there should be considerable absorbance difference. Similarly the two wavelengths 252 and 294 nm were selected for chlorzoxazone; at these two wavelengths absorbance difference was almost zero and there should be considerable absorbance difference in case of diclofenac sodium. In the mixture of diclofenac sodium and chlorzoxazone solution the absorbance values of the four wavelengths 252, 294, 264 and 288 nm were measured. The amount of diclofenac sodium is directly proportional to the absorbance difference between 252 and 294 nm. Similarly the amount of chlorzoxazone is directly proportional to the absorbance difference between 264 and 288 nm.

Key Words: Spectrophotometry, Determination, Diclofenac sodium, Chlorzoxazone, Absorbance difference method.

INTRODUCTION

The combination formulations of diclofenac sodium and chlorzoxazone have been in the market for their use. Literature describes various methods for the analysis of diclofenac sodium[1–7] and chlorzoxazone[8] as individual drug products. No method for the simultaneous analysis of diclofenac sodium and chlorzoxazone in binary tablet formulations has been reported in literature. The aim of the present investigation is to develop a simple, rapid, precise, reproducible and economical method for the simultaneous analysis of the binary drug formulations by using absorbance difference method without any interference from each other.

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EXPERIMENTAL

A Spectronics 1001 spectrophotometer with 10 mm quartz cells was used for absorbance values of the drug solution. All the chemicals used were of analytical grade. AR grade methanol was used as solvent.

Preparation of standard diclofenac sodium solution: 50 mg of pure diclofenac sodium was dissolved in 50 mL methanol. Therefore, 1.0 mL of the stock solution was further diluted to 50 mL with methanol to get working concentration of 20 µg/mL.

Preparation of standard chlorzoxazone solution: 50 mg of pure chlorzaxazone was dissolved in 50 mL methanol to obtain the working concentration of 1 mg/mL. 1.0 mL of the above stock solution was further diluted to 50 mL with methanol to get working concentration of 20 µg/mL.

Preparation of mixed solution: Two solutions, the first containing 20 µg/mL of diclofenac sodium and the second containing 20 µg/mL of chlorzoxazone were used as mixed solutions. Four mixed standard solutions were made by taking 4, 3, 2 and 1 mL of diclofenac sodium solution into a series of test tubes and the chlorzoxazone stock solution was also added into a series of test tubes to keep the total volume at 5 mL.

Calibration curve:

Various aliquots (5, 6, 7 and 8 mL) of diclofenac sodium stock solution (20 µg/mL) was transferred into a series of 10 mL standard flasks and the volume in each flask was adjusted to 10 mL with distilled water. The absorbances of these solutions were scanned over the range of 210 to 304 nm. Again various aliquots of chlorzoxazone solution (20 µg/mL) were transferred into a series of 10 mL volumetric flasks and the volume in each flask was adjusted to 10 mL with distilled water. These solutions were scanned over the range of 210 to 304 nm. Two wavelengths 264 and 288 nm were selected for diclofenac sodium; at these two wavelengths the absorbance difference values are almost zero and in case of chlorzoxazone at the same wavelength 264 and 288 nm we have maximum absorbance difference. A calibration curve was drawn between the absorbance difference values of chlorzoxazone and the amount of chlorzoxazone in µg/mL. The amount of chlorzoxazone present in the sample was computed from the calibration curve. Similarly two wavelengths 252 and 294 nm were selected for chlorzoxazone; at these two wavelengths the absorbance difference was almost zero and in case of diclofenac sodium we have maximum absorbance difference values at the same wavelengths 252 and 294 nm. A calibration curve was drawn between the absorbance difference values of diclofenac sodium and the amount of diclofenac sodium in µg/mL. The amount of diclofenac sodium present in the sample was computed from the calibration curve.

Various aliquots of mixtures of diclofenac sodium and chlorzoxazone solutions in different proportions were transferred into a series of test tubes and the volume in each test tube was made up to 5 mL with distilled water. The absorbance values were measured at two wavelength 252 and 294 nm for estimation of diclofenac sodium and two wavelengths 264 nm and 288 nm for estimation of chlorzoxazone. A calibration curve was drawn between the absorbance difference values of diclofenac sodium and the amount of diclofenac sodium present in μg/mL. A calibration graph was drawn between the absorbance difference values of chlorzoxazone and the amount of chlorzoxazone present in μg/mL. A linear curve in each case was obtained. The linearity of the curves obtained indicates that it obeys Beer's law and the suitability of this method for the simultaneous determination of the two drugs in admixture.

Estimation of diclofenac sodium in pharmaceutical formulations

Twenty tablets were weighed and powdered. An average weight of the tablet containing the two drugs diclofenac sodium and chlorzoxazone in the ratio of 1 : 5 and the amount of 50 mg was dissolved in 30 mL methanol by vigorously shaking and the volume was made up to the mark. The solution was then filtered through Whatmann filter paper No. 41 and the solution was diluted to get a final concentration of 25 μg/mL of diclofenac sodium and 125 μg/mL of chlorzoxazone. The sample solutions were measured at 252 and 294 nm for diclofenac sodium and 264 and 288 nm for chlorzoxazone in a Spectronics-1001, spectrophotometer. The results are represented in Table-1.

TABLE-1
ESTIMATION OF DIFFERENT BATCHES OF DICLOFENAC SODIUM AND CHLORZOXAZONE IN COMBINED DOSAGE FORMS

Batches	Label claim (mg/tab)		[a]Drug content by proposed method	
	[b]DS	[c]CZ	[b]DS	[c]CZ
I	50	250	49.4	250.5
II	50	250	49.8	249.4
III	50	250	50.2	249.8

*Average of five determinations. [b]Diclofenac sodium. [c]Chlorzoxazone.

Validation of method

The method was validated in terms of linearity, accuracy, precision, specificity, and reproducibility of the sample applications. The linearity of the method was investigated by serially diluting the stock solutions of diclofenac sodium (20 μg/mL), chlorzoxazone (20 μg/mL) and measured the absorbance values at 252 and 294 nm for diclofenac sodium and 264 and 288 nm for chlorzoxazone in a Spectronics-1001 spectrophotometer. Calibration curves were constructed by plotting the absorbance difference values against the amount of drug in μg/mL.

RESULTS AND DISCUSSION

The present study was carried out to develop a simple, rapid, sensitive, precise, reproducible and accurate spectrophotometric method for the estimation of simultaneous determinations of diclofenac sodium and chlorzoxazone in pharmaceutical dosage forms. The proposed absorbance difference method was simple, less time consuming, low cost and found to be one of the best versatile analytical techniques employed for routine analysis purposes like assay and pharmaceutical formulations. No method for the simultaneous analysis of diclofenac sodium and chlorzoxazone in binary tablet formulations has been reported in the literature by absorbance difference method. The content of diclofenac sodium and chlorozoxazone in four different tablet dosage forms is shown in Table-1. The absorbance of various aliquots of mixture of diclofenac sodium and chlorzoxazone solutions was measured at two wavelengths 252 and 294 nm for diclofenac sodium and at 264 and 288 nm for chlorzoxazone. A calibration curve was drawn between the absorbance difference of diclofenac sodium and the amount of diclofenac sodium in μg/mL. The amount of diclofenac sodium present in the sample was computed from the calibration curve. Similarly, for the estimation of chlorzoxazone, a calibration graph is plotted between the absorbance difference values of chlorzoxazone and diclofenac sodium against the amount of chlorzoxanone in μg/mL. The amount of chlorozoxazone in the sample was read from calibration curve.

The results obtained by proposed method are in good agreement with the label claims. The additives and excipients usually present in the tablet do not interfere. As a check on accuracy of the method, recovery experiment was performed and per cent recovery values were ranged from 99.5 to 100.4%.

In conclusion, the results indicate that the proposed absorbance difference method was found to be simple, rapid, precise, highly accurate and less time consuming. Hence it can be used for the routine analysis of simultaneous determination of diclofenac sodium and chlorzoxazone in pharmaceutical formulations.

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